ATTRIBUTES AND EFFECT OF IMPLEMENTATION OF WAREHOUSE MANAGEMENT SYSTEM (WMS) FOR COMPANY SUSTAINABILITY

Ajeng Febriani Samsudin[1]*, Bambang Darmawan[1], Vina Dwiyanti[1], Jonah Mupita[2]
[1]Faculty of Technology and Vocational Education, Universitas Pendidikan Indonesia, Jl. Dr. Setiabudi No. 229, Isola, Sukasari, Bandung, Jawa Barat 40154, Indonesia
[2]Computer Training School, Ruya Adventist High School, PO Box 49, Mt. Darwin, Darwin, Zimbabwe
*ajengfebrianisamsudin@upi.edu

ABSTRACT

This research discusses the effect of implementing a Warehouse Management System (WMS) on company continuity by coordinating and integrating other systems that will directly control the important attributes of a physical warehouse as a facility for warehouse operational activities. The aim of this research is to answer specific questions regarding the important attributes of a warehouse with optimal WMS implementation, which will have a significant impact on the company. This research was conducted using the Systematic Literature Review (SLR) method with references from various literature sources discussing WMS research results in the last 10 years. The results of this research state that optimal implementation of WMS in a company's warehouse will have a significant effect on the smooth running of warehouse operations, which will increase customer relationships and customer satisfaction. This happens because there are minimal errors and obstacles that will occur during the process of controlling and managing goods as a whole in the warehouse until they are sent to consumers. Optimal implementation of WMS is a more effective and efficient solution than manual warehouse management and control in the current era of technology.

Keywords: attribute; implementation; system; warehouse; wms

INTRODUCTION

Discussing warehouses means not avoiding discussions about the business world related to the trade of industrial goods in the production section (Makatengkeng, Jan, & Sumarauw, 2019). A warehouse is a storage place so that goods remain in a safe condition, not just for storing without paying attention to the condition of the goods to be stored (Hidayat, Novita, Yandi, & Ulpah, 2021). Storing goods in a warehouse requires paying attention to the quantity and shelf life of the goods to be distributed to the destination location so that they can reach consumers in optimal conditions according to demand (Syarif, et al., 2023).

This means that storing goods in the warehouse is not just about goods coming in and out but also accompanied by a flow of related information that connects supply chain points to meet consumer needs (Wijaya & Andriani, 2023). There are three stages in warehouse operational management: input, operation, and output (M, F, & W, 2016). Inbound, namely when goods move into the warehouse with prior administration of the goods being taken care of. Operation, namely when goods move within the warehouse between various warehousing facilities. Outbound, namely when goods move out of the warehouse to be distributed until they reach consumers according to the specified quantity and time span (Kusuma, Sumarauw, & Wangke, 2017). Based on the three stages in warehouse operational management, there are five warehouse operational processes: receiving, moving, put away, picking, and shipping/delivery (Suchui, Jinjun, & Hongli, 2020).

Efficient storage of goods in a warehouse means that the most important thing to pay attention to is the storage layout inside (Supriyadi & Srikandi, 2023). Things like this make the use of storage space more optimal and the stored goods will be easier to control when carrying out the movement process from receiving goods into the warehouse to sending goods out of the

warehouse (Zain, Farezan, Ghufron, & Sahara, 2023). This control is important to make it easier to know the accurate amount of inventory stored in accordance with administrative records in real-time (Jacobus & Sumarauw, 2018).

Discussing administration, recording of goods greatly effects the classification, specifications, quantity and quality of goods received. If administrative recording or archiving is correct, then goods management activities will be easier (Febriyanti, Yasin, Sabrina, & Istanti, 2023). Easy here means that it will support all activities in the warehouse to ensure continuity and sustainability of the goods management activities that will be controlled (Yanuar & Rahmatulah, 2019). Control of the goods in question aims to smooth supply and distribution activities (Saragih, Hartati, & Fauzi, 2020), controlling goods in the warehouse is one of the activities in supply chain management that is coordinated and collaborates with other activities such as information flow, finance, procurement, product design, production, marketing, sales, and logistics (Yusuf & Soediantono, 2022). If goods are controlled properly from the start, it will provide a great opportunity to avoid sales failures, which result in the company's operational cycle being hampered and experiencing losses (Jaryanto, Rovita, & Pramudita, 2023).

A company's warehouse operational system is adjusted to the Standard Operating Procedure (SOP) in an effort to reduce the level of losses that the company may experience (Rahardjo & Surya, 2017). One of the operational standards with technological advances is a system known as the Warehouse Management System (WMS) which can be applied to managing various warehousing information in a company (Afif, Pratikto, & Sumantri, 2023). However, the implementation of WMS is still being strongly considered by companies founded by new business players and old business people so that they continue to develop following technological developments (Putri & Nurcaya, 2019). It turned out that these considerations were quite scary for them, one of which was considering the company's financial matters for financing system implementation (Bantacut & Fadhil, 2018).

Based on the description above, the research that will be carried out is research on what attributes and how the implementation of WMS effects the activities of managing and controlling warehouses in companies for the continuity of the company. The research was conducted to find out how important and what considerations companies have for implementing WMS so that control of goods in the warehouse is in accordance with standards. The research was carried out by reviewing various pieces of literature discussing warehousing and the application of WMS.

METHOD

In this research, the research method used is the Systematic Literature Review (SLR) method, which summarizes various previous research results whose data are related to each other to be presented in a comprehensive and balanced manner. SLR as the method chosen in research is carried out by the process of identifying, assessing and interpreting various results of previous research with the aim of getting specific answers to questions from the research carried out. This SLR method has three main stages, namely planning, conducting, and reporting (Wahono, 2015). The steps for the research method using the SLR method can be seen in Figure 1 below:

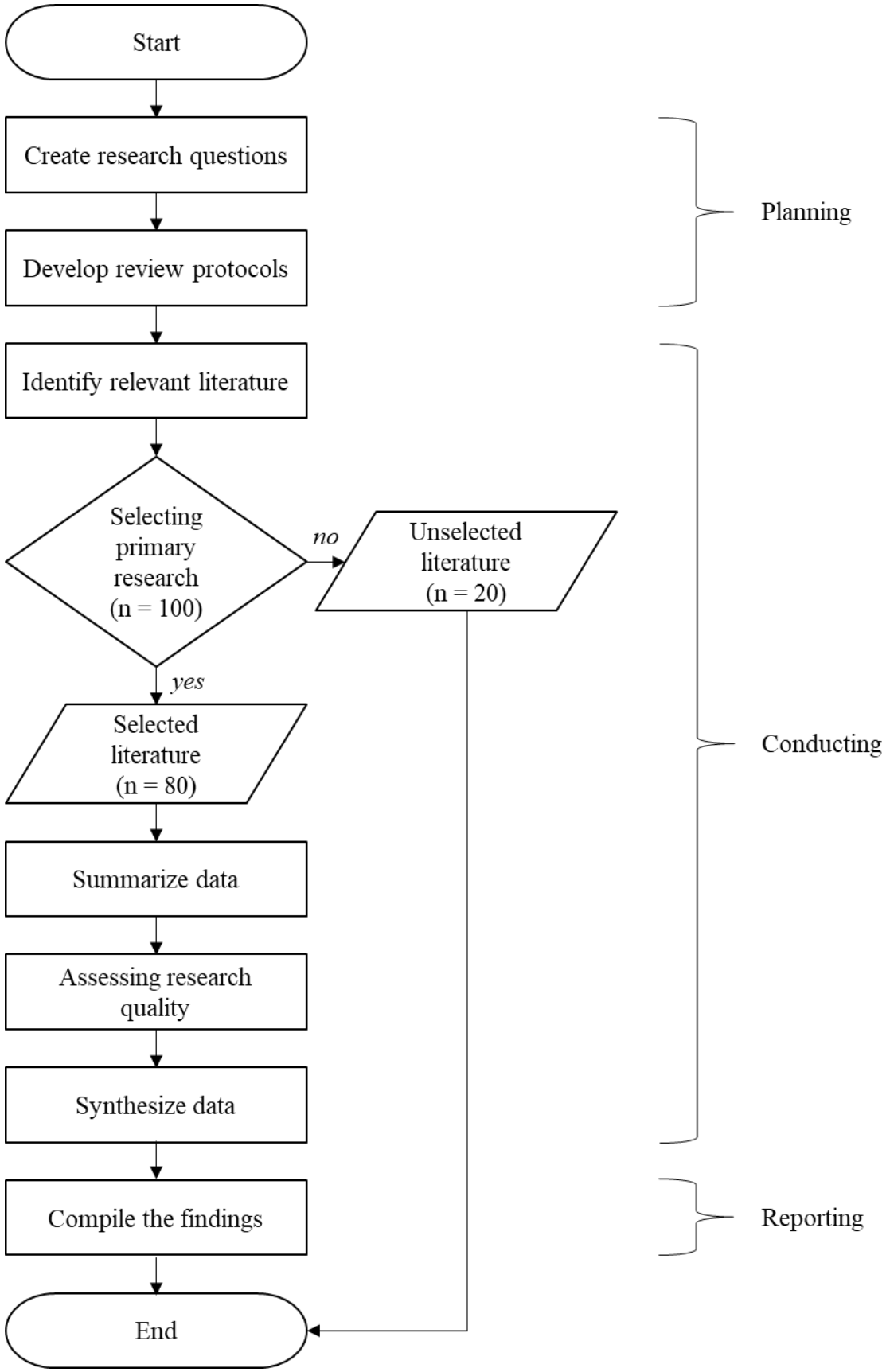

Figure 1. SLR Method Flow

Based on the steps of the SLR method, which have been carried out according to the flow in Figure 1, the following research questions were formed:

1. What are the trends in WMS implementation in Indonesia in the last 10 years?
2. What are the most influential attributes of a WMS?
3. What systems are integrated with WMS?
4. What are the effects of WMS implementation?

The questions that have been formed are answered based on the results of summarizing data obtained from various selected literature that is relevant to research on "Attributes and Effect of Warehouse Management System (WMS) Implementation for Company Sustainability". The selected relevant literature is the result of research carried out in the period from 2014 to 2023, sourced from various national and international journals totaling approximately 80 journals. This research prioritizes reference sources from literature in the form of journals so that the findings are in the form of reliable data.

RESULTS AND DISCUSSION

Description of the results and discussion of research based on the SLR method to answer specific questions regarding the research topic that was formed was carried out to identify the attributes and effect of WMS implementation on company continuity answered by collecting data sourced from various journal articles. Table 1 below contains a complete list of keywords and journal article sources relevant to the research topic:

Table 1.

List of Keywords and Journal Articles Dedicated to Each Keyword

No	Keywords	Description	Frequency of Appearance	Relevant Articles
1	Design	These keywords are mentioned in journal articles discussing warehouse layout.	6	(Hidayati & Purnomo, 2016)
2	Effective	This keyword is mentioned in a journal article that discusses the effect of WMS implementation as a solution for warehousing control and management in terms of achieving what the company wants.	4	(Azzahra & Fauziah, 2023)
3	Efficient	This keyword is mentioned in a journal article that discusses the effect of WMS implementation as a solution for warehousing control and management in terms of achieving maximum goals by minimizing resource expenditure.	4	(Sihaloho & Hidayati, 2023)
4	Warehouse	These keywords are mentioned in journal articles that discuss physical research objects for implementing WMS.	3	(Muthohir, Rakasiwi, & Ubaidillah, 2023)
5	Implementation	This keyword is mentioned in a journal article which discusses the application of a system called WMS to warehousing control and management.	4	(Ropianto, Suryadi, & Safitri, 2020)
6	Integration	This keyword is mentioned in a journal article that discusses other systems that are interconnected with the WMS system, which is implemented in warehouse control and management activities.	5	(Zhafarina, Kurniawan, Redi, & Ruswandi, 2021)
7	Location	This keyword is mentioned in a journal article that discusses one of the things that must be considered when building a warehouse.	119	(Purnomo, Isha, Dzikri, Novianto, & Sahara, 2023)
8	System	This keyword is mentioned in a journal article that discusses other coordination connected to WMS in warehousing control and management activities.	27	(Yansyah & Utami, 2023)
9	Technology	This keyword is mentioned in journal articles that discuss various uses of technology to help control and manage WMS system warehouses.	5	

Based on the keywords listed in Table 1, the four questions formed to complete research regarding the attributes and effect of WMS implementation on company continuity were answered by synthesizing and combining data from various journal article sources.

WMS Implementation Trends in Indonesia

WMS as smart management that changes warehouse activities to be completely automated will become a requirement in the future in the world of logistics in accordance with the industrial paradigm, which will of course continue to have trends from time to time. For example, in the last 10 years, the trend in WMS implementation in Indonesia has led to significant developments in increasing the use of technology (Purbasari, Novel, & Kostini, 2023), changes in policies and regulations as well as industry practices in making improvements (Wulandari, 2023), development of features and functionality and changes in system adoption and integration (Sulistyowati & Wijaya, 2022). The trend in WMS implementation in Indonesia in the last decade is as follows:

a. Increased use of cloud technology in WMS to prepare for future supply chain needs (Zaman, Khan, Zaman, & Khan, 2023).
b. The increasing implementation of WMS is increasingly widespread in various sectors, including the food, pharmaceutical, and manufacturing industries (Farohi, Fajar, & Ali, 2023).
c. The use of WMS as the main tool in managing the challenges of the reverse logistics trend or free return of goods (Khairunissa & Santosa, 2022).
d. The shift in WMS implementation from multi-channel to omnichannel not only allows companies to reach more consumers through various channels (Dhika, Witonohadi, & Akbari, 2023), rather, it will provide a smooth and consistent experience for consumers.

Warehouse Construction Attributes with WMS Implementation

There are two important things that must be considered when building a warehouse to implement WMS in warehouse control and management activities, which are referred to as attributes, namely:

a. Selection of warehouse location

Location selection is very important because it will affect cost calculations, location area, transportation conditions and market conditions of a company (Putri S. R., 2021). Certainly, activities within the company will definitely experience significant trends or changes from time to time considering the increasingly rapid technological developments which provide encouragement for the industry to digitalize (Adha, Asyhadie, & Kusuma, 2020). Choosing a warehouse location will effect the success of the business, for example by choosing a strategic location (Wahyudi & Heriyanto, 2014). Choosing a strategic location for the warehouse will minimize additional costs that might occur if the warehouse location is less strategic (Sanjaya & Purnawati, 2021). One of the problems is that the warehouse location is less strategic, which may occur, for example, when distributing goods due to limited transportation (Nugroho, Siregar, Andannari, Shafiyudin, & Christie, 2018). If the warehouse location is less strategic, it is possible that the choice of distribution travel route will be longer and take longer (Supriatna, Ciptaningtyas, & Supangkat, 2022), additional costs in this case are additional transportation costs (fuel) which are also high (Iqbal, Hasan, & Gusmon, 2020).

b. Determining warehouse layout

Determining the design, namely the layout of the warehouse, needs to be considered considering that the goods that will be stored in it must receive special attention and handling (Rafli, 2022). This handling aims to store goods in order to achieve the main goal of keeping the goods in safe and prime condition until they reach the consumer (Aiba, Palandeng, & Karuntu, 2022). Accurate warehouse layout will help reduce the occurrence of obstacles in the

supply chain or goods management activities in the warehouse, such as increasing the amount of stock differences due to irregular storage to delays in delivery due to many disruptions in the warehouse process (Naomi & Fauziah, 2023).

Considerations in determining the warehouse layout must take into account several things such as: space utility, tools, and person stature (Putri & Marie, 2015), flow of information, materials or components (Fajri, 2021), goods and services (Ramdan, Arianto, & Bhirawa, 2020), the behavior of people as employees who carry out control and management in the warehouse as well as the work environment for employee productivity (Ramadhan, 2017), interaction between the company and customers (Kuswoyo & Cahyana, 2016), also flexibility (Panjaitan & Azizah, 2020). In the activity of determining the warehouse layout, it can be done by applying the ABC analysis method to determine the storage grouping of materials or components and goods according to the type classification based on movement frequency, namely class A (fast moving), class B (medium moving), and class C (slow moving) (Febrianty, Adhiana, & Waluyo, 2021).

Systems and Technology Integrated with WMS

The aim of implementing a WMS is so that the warehouse can become a coordinated interface with various systems that will be integrated with each other (Herdianzah, et al., 2022). Various systems that will be integrated with WMS include:

a. Enterprise Resource Planning (ERP) System

The better the interface with the ERP system, the better the WMS implemented in a company. The ERP system is company resource planning (Yulfiswandi, et al., 2023), as an information system model that, if used by an organization, will enable easy automation and integration of the various main business processes that it will carry out (Parlika, Hidayat, Putra, & Satria, 2018). Traditionally, ERP will solve the deadlock of various obstacles by providing facilities for sharing and accessing data (Sagala, et al., 2021), supports corporate information systems as well as channeling business practices to users within the organization (Saridewi, Putra, & Sukarsa, 2021). There are many modules that can support various business practices and carry out standard processes (Fratiwi, Fitriani, Indrijawati, & Irdam, 2022) can be seen in Figure 2:

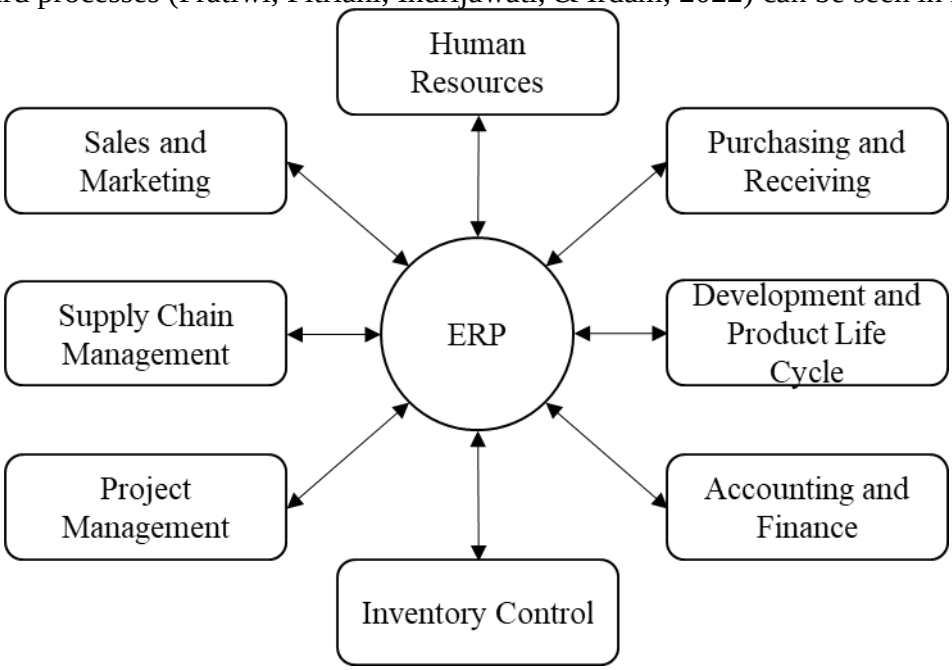

Figure 2. ERP System Module

Source: (Fratiwi, Fitriani, Indrijawati, & Irdam, 2022)

b. Material Requirement Planning (MRP) System

The MRP system is a system that is useful for calculating the amount of raw materials or components that a company needs to produce goods (Pratama & Latipah, 2019). The interface with the MRP system will make it easier to control goods that will be stored in the warehouse so that there is no excess of materials or components according to the warehouse's carrying capacity (Arief, Supriyadi, & Cahayadi, 2018).

c. Transportation Management System (TMS) System

The TMS system is a system that is useful for managing company transportation management. Management in this system is logistics automation for carrying out transportation management so that it is synchronized periodically and continues to reduce the manual data input process (Darmawan & Sutanto, 2023).

d. Material Handling Equipment (MHE) Technology

In today's sophisticated era, all things and activities never escape the use of technology to help all forms of human work. Carrying out control and management in the warehouse, for example, utilizes technology, including the use of machines to handle materials in the warehouse, called MHE. Apart from that, there is also the use of information scanning technology, such as the use of barcodes, Radio Frequency Identification (RFID), and many more.

MHE itself is technological equipment used to carry out transfers (Ahmady, Martini, & Kusnayat, 2020), storage and delivery of goods to be more efficient (Nugroho F. A., 2022). The use of ergonomic equipment will help reduce injuries to human workers and increase productivity when doing work (Anwardi, Permata, Nofirza, & Harpito, 2019). Apart from technology in transportation equipment, the technology used for information systems related to the static presence of materials or components and goods stored in warehouses is RFID (Sucianto, Gosal, & Lisangan, 2022). Utilization of this technology will make it easier to implement methods of controlling goods stored in warehouses using various methods such as First In, First Out (FIFO), Last In, First Out (LIFO), and First-Expired, First-Out (FEFO) regularly. Apart from this, such information technology will increase the security of goods stored in warehouses (Zulfikar, Saputra, Maulana, Cahyono, & Sahara, 2023).

The Effect of WMS Implementation on Company Sustainability

Carrying out control in the warehouse starts with administrative activities for each incoming material or component and goods carried out both data and physically. So, the number and type of goods entering the data warehouse must match the data and the physical form (Meisak, 2017). If the number in the warehouse has decreased, it means that the document data has also changed. Every time you carry out administration, each company has a different software usage policy. Both software that the company makes itself and software purchased from software service providers.

Implementing a WMS that is integrated with various systems in a company will certainly have a very significant impact on the continuity of the company. These effects are listed in Table 2, among others:

Table 2.
Effect of WMS Implementation

No.	Effect of WMS Implementation
1	Improve inventory accuracy (Widowati & Ningtyas, 2022)
2	Increase supply chain efficiency (Haryanto & Santosa, 2022)
3	Increase productivity, work quality and employee performance (Padhil, Rini, & Husni, 2023)
	Increase processing speed (Wibowo, 2020)
4	Increase work accuracy and results (Akbar, R, & Syamil, 2021)
5	Improve overall control such as shipping, receiving, put away, move, and picking (Haslindah, Fadhli,
6	Adrianto, & Mansyur, 2017)
	Makes the distribution process easier (Indriyani, 2020)
7	Reducing administrative costs by using software and making it easier to modify the company's own
8	interface and software features (Dewi & Shofa, 2023)
	Streamlining the flow of goods (Rahayu, Ma'ruf, & Sunarsa, 2022)
9	Improving occupational safety and health (Hasan, Arif, Melliana, Julanos, & Rahmi, 2023)

Based on table 2, the various effects of optimal WMS implementation in controlling and managing the warehouse as a whole will reduce the total cost of activities which is calculated to be lower because there is less occurrence of human error causing losses for the company (Gustiawan, Butarbutar, & Joanda, 2023). Effective, accurate management of data and information in the warehouse and the credibility of the exchange make various flows from upstream to downstream smoother. This provides a level of operational efficiency, optimizes resource use and increases consumer satisfaction (Prasidi & Lesmini, 2019).

CONCLUSION

Based on the presentation of the results and discussion described above, there are two important attributes that must be considered to build a warehouse with WMS implementation, namely location selection and warehouse layout design. Optimal WMS implementation means coordinating and integrating WMS with other systems, such as ERP, MRP, TMS and MHE technology systems to carry out comprehensive warehouse control and management. The results of implementing a coordinated and integrated WMS will have a significant impact on the continuity of the company because it makes various operational activities in the warehouse more effective and efficient with optimal use of resources to increase consumer satisfaction and loyalty. This can be a strong reason why companies must think carefully about implementing WMS, even though the initial investment is quite high. In fact, in the future, it will continue to provide many benefits for the sustainability of the company.

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